



Docket No.: 35836-2001101  
(PATENT)

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE  
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES**

In re Patent Application of:

**David A. DALMAN, et al.**

Serial No.: **09/880,834**

Filing Date: **June 15, 2001**

For: **BALLISTIC-RESITANT ATRICLE AND  
PROCESS FOR MAKING THE SAME**

Examiner: **Elizabeth M. COLE**

Confirmation No.: **7037**

Group Art Unit: **1771**

Customer No.: **25227**

**APPELLANTS' OPENING BRIEF**

Customer Window, MS Appeal Brief - Patents  
U.S. Patent and Trademark Office  
2011 South Clark Place  
Crystal Plaza Two, Lobby, Room 1B03  
Arlington, Virginia 22202

Sir:

**I. REAL PARTY IN INTEREST**

The real party in interest for this appeal is Toyobo Co., Ltd.

**II. RELATED APPEALS AND INTERFERENCES**

There are no other appeals or interferences within the meaning of 37 CFR 1.192(c)(2) known to appellants or appellants' undersigned counsel.

**III. STATUS OF CLAIMS**

Claims 1-15 (reproduced in the attached Appendix), are pending in this application.

Claims 1-10 and 13-15 are finally rejected under 35 USC 102(e) as being anticipated by

Weber (U.S. Patent No. 5,233,821).

Claims 11 and 12 are finally rejected under 35 USC 103(a) as being unpatentable over Weber in view of Dunbar (U.S. Patent No. 5,119,512).

**IV. STATUS OF AMENDMENTS**

No amendments have been submitted subsequent to the final rejection.

**V. SUMMARY OF INVENTION**

The invention is directed to ballistic-resistant fabric or clothing articles that have ballistic resistance suitable for use as soft armor. The articles are made of polybenzoxazole (PBO) polymer fibers. (See p. 2, l. 29). The fibers are untwisted. (See p. 10, ll. 23 and 24). The fibers also have a fiber fineness of no more than 500 denier. (See page 10 line 35).

Ballistic-resistant articles are articles that resist the penetration of projectiles moving at high velocities, such as a bullet shot from a gun. (See Example 1, p. 15, ll. 1-10). Such articles include bulletproof vests, raincoats, military aircraft seats, military troop shelters, boot soles and other personal protective items. (See p. 1, ll. 7-24).

The optimum denier of the fibers depends on their desired use. For soft armor applications lower deniers, specifically fibers of no more than 500 denier, are utilized. (see page 10, line 33-35).

**VI. ISSUES PRESENTED FOR REVIEW**

Whether the Examiner erred in rejecting claims 1-10 and 13-15 under 35 USC 102(e) as being anticipated by Weber and claims 11 and 12 under 35 USC 103(a) as being unpatentable over Weber in view of Dunbar.

**VII. GROUPING OF CLAIMS**

Claims 1-10 and 13-15 stand or fall together as one group. Claims 11 and 12 stand or fall together in a group separate from claims 1-10 and 13-15.

### **VIII. ARGUMENTS**

**A. The rejection of claims 1-10 and 13-15 under 35 USC 102(e) as being anticipated by Weber should be reversed.**

Claims 1-10 and 13-15 stand rejected under 35 USC 102(e) as being anticipated by Weber. Claims 1-10 and 13-15 claim a fabric or clothing article made of a plurality of PBO fibers. The article has ballistic resistance suitable for use as soft armor and the fibers are untwisted and are of no more than 500 denier.

A ballistic resistant article is designed to withstand a high velocity impact. Such an impact causes a tensile force that acts on the filaments of the article. To withstand this tensile force, ballistic resistant articles are designed to spread the force across the greatest possible area. To this aim, the fibers of ballistic resistant articles are designed to optimize the tensile strength of the lengthwise filaments.

Weber discloses only cut resistant articles. (Weber, col. 1, ll.6-8) A cut resistant article is designed to withstand a shear force applied by sharp blades. To maximize resistance to shear forces, cut resistant articles are typically made of discontinuous fibers that are made into articles having a bulky structure. The tensile strength of the filaments does not directly affect the cut resistance of the garment, but the shear strength does.

The difference between the requirements of a ballistic resistant article and a cut resistant article is also shown by the difference in fiber denier and fiber twisting used by appellants and Weber. The articles claimed by appellants use fibers that “are untwisted and are no more than 500 denier.” Attached to the response dated December 4, 2004, is the declaration of Yakihiro Nomura. Mr. Nomura conducted an experiment in which a fabric with a fiber denier of 1000 was compared to a fabric with a fiber denier of 500. In addition, Mr. Nomura compared the ballistic resistance of a 500 denier fabric made of untwisted fibers to a 500 denier fabric of twisted fibers. The results of

the experiments showed that the use of untwisted fibers and a denier of no more than 500 unexpectedly and markedly improved the ballistic resistance of the fabric.

In comparison, Weber advocates the use of fabrics having a denier above 500 and does not suggest the benefits of using untwisted fibers. Specifically, Weber states that “most preferably” the fibers have a denier of at least about 500 denier. (See Weber, col. 5, ll. 26) Weber also states that the filaments can be held together by twisting them and provides a typical number of twists per inch. (Weber, col. 5, ll. 16-21). No where does Weber mention or even suggest any benefit to using untwisted yarns. Finally, all of the Examples in Weber utilize twisted PBO yarns having a denier of over 500.

Although the Examiner admits that Weber fails to disclose a ballistic resistant article, the Examiner contends that this property would be inherent since “Weber would have at least some ballistic resistance.” (Office Action dated June 4, 2003, paragraph 5) The Examiner is in error since the claims are not directed to a fabric with “some ballistic resistance”; rather, the claims specify that the article has “ballistic resistance suitable for use as soft armor.” Ballistic resistance is affected by many properties of the fabric including the denier of the yarns used and whether the yarns are twisted or untwisted. Weber fails to suggest using the combination of an untwisted yarn and a denier of not more than 500 as claimed by appellants. As described in Mr. Nomura’s declaration, the ballistic resistance of the claimed PBO fabrics is a result of both of these properties. Furthermore, the Examiner has presented no reasoned factual basis to believe that Weber would inherently disclose the claims ballistic resistant articles.

Since Weber fails to describe a ballistic resistant article as claimed and since Weber fails to describe an article having both untwisted yarns and a denier of not more than 500, this rejection should be reversed.

**B. The rejection of claims 11 and 12 under 35 USC 103(a) as being unpatentable over Weber in view of Dunbar should be reversed.**

Claims 11 and 12 stand rejected under 35 USC 103(a) as being unpatentable over Weber in view of Dunbar. Claims 11 and 12 depend from claim 1 and, therefore, include all of the limitations of claims 1. As discussed above, claim 1 claims a fabric or clothing article made of a plurality of PBO fibers. The article has ballistic resistance suitable for use as soft armor and the fibers are untwisted and are of no more than 500 denier.

Weber fails to describe a ballistic resistant article suitable for soft armor. Further, Weber fails to describe an article having both untwisted yarns and a denier of not more than 500. Dunbar is only cited by the Examiner to show that fibers that are formed into fabrics can be impregnated with a matrix resin.

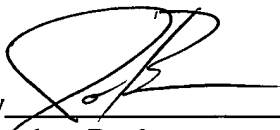
Since Weber and Dunbar fail to describe a ballistic resistant article as claimed and since Weber and Dunbar fail to describe an article having both untwisted yarns and a denier of not more than 500, this rejection should also be reversed.

#### **IX. CONCLUSION**

For the foregoing reasons, appellants respectfully request that the rejections of claims 1-10 and 13-15 under 35 USC 102(e) as anticipated by Weber and claims 11 and 12 under 35 USC 103(a) as being unpatentable over Weber in view of Dunbar should be reversed.

Dated: **August 12, 2004**

Respectfully submitted,

By   
Jonathan Bockman

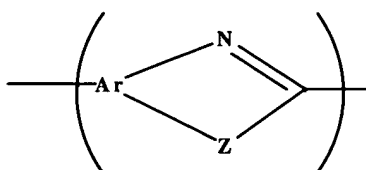
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**APPENDIX OF APPEALED CLAIMS**

1. A fabric or clothing article made of a plurality of polybenzoxazole polymer fibers, wherein said article has ballistic resistance suitable for use as soft armor and the fibers are untwisted and are of no more than 500 denier.

2. The article of Claim 1 wherein the polybenzoxazole polymer contains a plurality of repeating units which are predominantly AB-mer units represented by the Formula:



wherein:

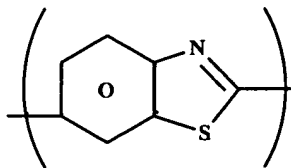
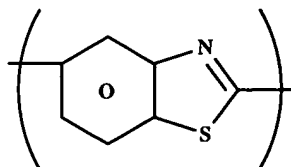
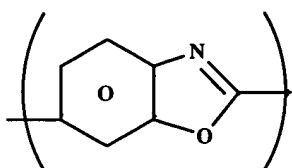
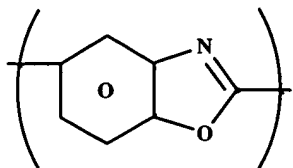
each Ar represents an aromatic group;

each Z is independently an oxygen or a sulfur atom; and

the nitrogen atom and the Z moiety in each azole ring are bonded to adjacent carbon atoms in the aromatic group, such that a five-membered azole ring fused with the aromatic group is formed.

3. The article of Claim 2 wherein each Ar in the AB-mer units is a 1,3,4-phenylene moiety or an analog thereof.

4. The article of Claim 2 wherein each AB-mer unit is independently represented by one of the Formulas selected from:



5. The article of Claim 1 wherein the polybenzazole polymer contains a plurality of mer units that are predominantly AA/BB-mer units represented by the Formula:

wherein:

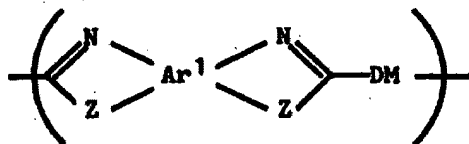
each Ar1 represents an aromatic group;

each Z is independently an oxygen or a sulfur atom;

each DM is independently a bond or a divalent organic moiety that does not interfere with the synthesis, fabrication or use of the polymer;

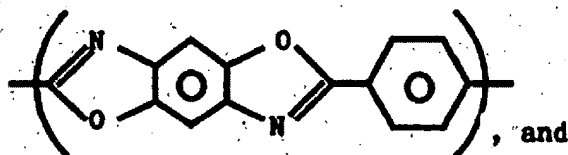
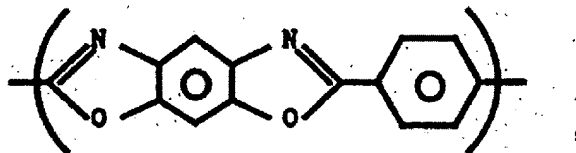
the nitrogen atom and the Z moiety in each azole ring are bonded to adjacent carbon atoms in the aromatic group, such that a five-membered azole ring fused with the aromatic group is formed; and

the azole rings in AA/BB-mer units may be in cis- or trans- position with respect to each other.

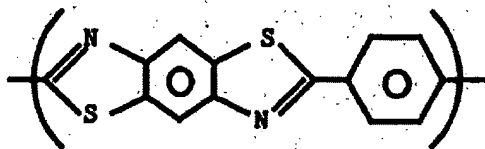


6. The article of Claim 5 wherein each DM in the AA/BB-mer units is an aromatic group, and each aromatic group in the AA/BB-mer units contains no more than about 12 carbon atoms.

7. The article of Claim 5 wherein each AA/BB-mer units is independently represented by one of the formulas selected from:







8. The article of Claim 1 comprising yarns containing polybenzazole fibers.
9. The article of Claim 1 comprising polybenzazole fibers woven with a second fiber.
10. The article of Claim 9 wherein the second fiber is cotton, polyester, nylon or rayon.
11. The article of Claim 1 in the form of a laminate comprising a plurality of plies of PBO fabric and a polymeric matrix.
12. The article of Claim 11 wherein the polymeric matrix is a thermoplastic polymer, a thermosetting polymer or an elastomeric polymer.
13. The article of Claim 1 in the form of a bulletproof vest, helmet, structural member of helicopters and other military equipment, vehicle panel, briefcase, raincoat, aircraft luggage container, military aircraft seat, gas turbine engine containment ring, military troop shelter, boot sole, overwrapping or overbraiding of telephone electrical lines and aerospace wires and cables, or military electronic shelter.

14. The article of Claim 1 in the form of a consolidated fiber network.

15. The article of Claim 1 in the form of a bulletproof vest, helmet, structural member of helicopters and other military equipment, vehicle panel, briefcase, raincoat, aircraft luggage container, military aircraft seat, gas turbine engine containment ring, military troop shelter, boot sole, overwrapping or overbraiding of telephone electrical lines and aerospace wires and cables, or military electronic shelter.